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# IMPACT OF SANITARY AND PHYTOSANITARY MEASURES AND TECHNICAL BARRIERS TO TRADE ON EXPORT OF RICE FROM INDIA TO EUROPEAN UNION, UNITED STATES OF AMERICA AND JAPAN


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**ABSTRACT**

This paper delves into the impact of Sanitary and Phytosanitary measures (SPS) and Technical Barriers to Trade (TBT) on Indian rice (HS 1006) exports to key destinations—the European Union, United States of America, and Japan. With India being a major rice producer and exporter, accounting for a significant portion of global rice exports, understanding the influence of these trade regulations is vital. My analysis, spanning from 2001 to 2020, examines the trade flows of Indian rice, considering factors like GDP per capita, tariff rates, and SPS and TBT measures. The results indicate that an imposition of SPS and TBT regulations by the European Union, United States of America and Japan correlates with lower Indian rice exports, highlighting India's lack of capacity to produce high quality rice that is in line with global standards.

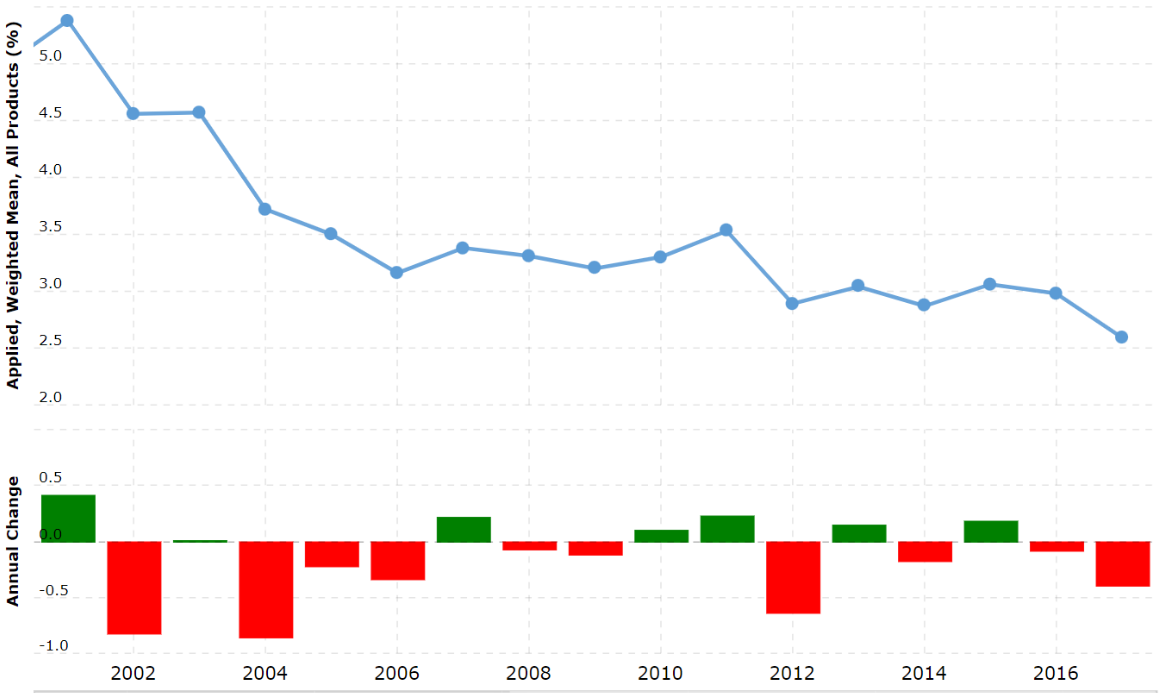
## 1. INTRODUCTION

Sanitary and Phytosanitary measures (SPS) as well as Technical Barriers to Trade (TBT) play significant roles in international discussions. In recent years, the gradual reduction of global tariff levels, facilitated by various trade negotiations and agreements at multilateral, regional, and bilateral levels, has drawn attention to the growing significance of Non-Tariff Barriers (NTBs) in shaping international trade. Members of the World Trade Organization (WTO) are required to provide notifications about their non-tariff measures related to environmental protection, wildlife conservation, and various measurements. These notifications are gathered and assessed by UNCTAD (United Nations Conference on Trade and Development), and they are categorized into seven distinct groups:

- Para-tariff measurements
- Price control measurements
- Finance measurements
- Automatic licensing measurements
- Quantity control measurements
- Monopolistic measurements
- Technical measurements

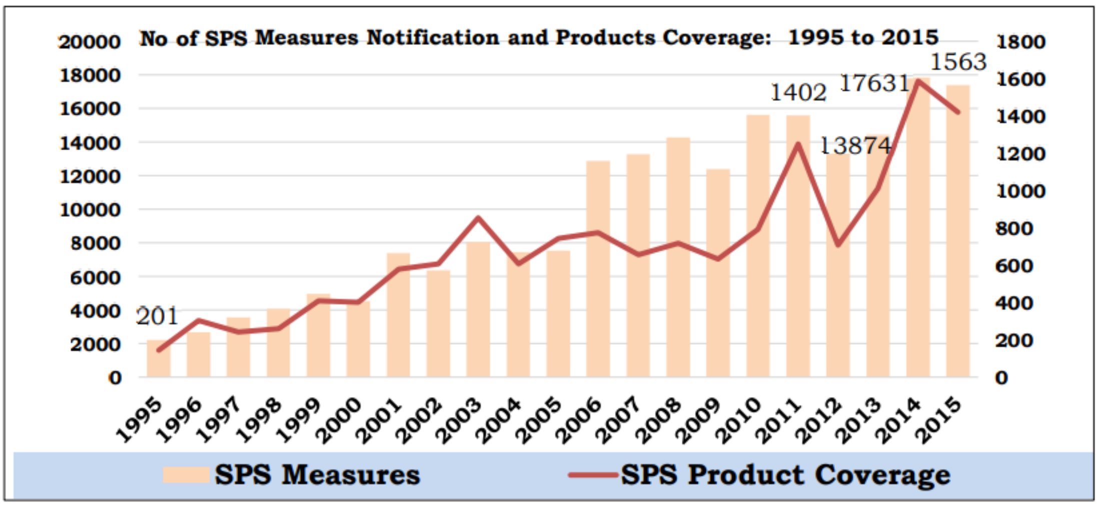
In our empirical analysis, we concentrate on measurements that fall under both Sanitary and Phytosanitary (SPS) agreements and Technical Barriers to Trade (TBT) agreements. These barriers encompass all the measurement categories mentioned above. Globally, there has been an increase in Non-Tariff Measures (NTMs) (shown in Figure 2) with a decrease in applied MFN tariffs (shown in Figure 1).

Figure 1: Applied MFN tariff rates




Source: WTO website.

Figure 2: SPS Notification made to the WTO by 164 Members




Source: Centre for WTO Studies, Web Portal on SPS and TBT measures.

Figure 2 depicts that SPS notifications to WTO by its members have increased from 201 in 1995 to 1,563 in 2015. Since 1995 SPS notifications have increased with 13 percent growth rate for both developed and developing countries. SPS measures are applied to protect human, animal or plant life or health from risks arising from plant pests, additives, residues, contaminants, toxins or disease- causing organisms in food, feed and drinks.

The European Union has established a maximum allowable level for aflatoxin B1 in rice, which is set at 5mg/kg. According to data from the RASFF portal, there were 12 notifications recorded between 2000 and 2016 concerning rice contamination with aflatoxin B1. These notifications indicated that the levels of aflatoxin B1 in the rice exceeded the established limit, ranging from 5.5 mg/kg to 9.5 mg/kg. From January 1, 2000 to April 30, 2016, the RASFF portal recorded 42 notifications regarding Basmati rice exported from India not meeting EU standards. Among these notifications, 25 out of the 42 faced what is termed 'border rejection.' This means that the shipments were denied entry into the EU due to concerns about potential risks to human health, animal health, or the environment. The highest number of notifications occurred in the year 2014, with a total of 16 notifications during that period. In the case of tricyclazole, various countries have established different import tolerance limits. To illustrate, the United States has set the import tolerance for Indian rice at 3 parts per million (ppm). Conversely, the European Union (EU) had a Maximum Residue Limit (MRL) of 1 ppm for tricyclazole in rice, while Japan permits an MRL of 3 ppm. EU has further reduced the MRL of tricyclazole to 0.01 mg/kg in 2017. In 2013, Indian rice exports faced SPS issues in the US due to the presence of residues of tricyclazole.

Table 1: MRL Standards and Stringencies on Rice

| Countries | Number of MRL Standard on Active Ingredients | | | |
|---|---|---|---|---|
| | Codex Standards | Country’s Standards | Equal to or less stringent than Codex | More stringent than Codex |
| EU | 32 | 58 | 24 | 6 |
| USA | 32 | 69 | 22 | 10 |
| Japan | 32 | 52 | 15 | 12 |

Maximum Residue Limits (MRL) set the standard prescription on active ingredients for the entry of any agricultural product. The Codex standards consist of globally acknowledged standards, codes of practice, guidelines, and additional recommendations issued by the Food and Agriculture Organization of the United Nations. These pertain to various aspects of food, including food production, food labeling, and food safety. Table 1 shows the number of MRL standards set for rice by Codex and respective importing countries. It shows that the above three countries- EU, USA and Japan have some MRL standards that are more stringent than the Codex standards with Japan setting the most stringent MRL standards.

This paper sought to examine the impact that SPS and TBT measures have on Indian rice exports to the European Union, United States of America and Japan. India is the second largest producer of rice and the largest exporter of rice, accounting of nearly 40 percent of world's total rice exports, which is projected to reach 54 million tonnes over the year 2022-2023.

## 2. LITERATURE REVIEW

In recent years, the gradual reduction of global tariff levels, facilitated by various trade negotiations and agreements at multilateral, regional, and bilateral levels, has drawn attention to the growing significance of Non-Tariff Barriers (NTBs) in shaping international trade dynamics (Fugazza 2013; Moise and Le Bris 2013; Kareem 2014). This shift is underscored by evolving consumer preferences in importing countries and an increasing emphasis on environmental safety, particularly in developed markets. Consequently, there has been a notable uptick in the demand for Sanitary and Phytosanitary (SPS) measures to ensure the quality and safety of agricultural products. Between 1996 and 2015, the global average tariff rate for agricultural products, as measured by simple average rates, witnessed a substantial decline from 14.6% to 8.8%. In parallel, the total number of SPS notifications related to agricultural products (classified under HS Codes 01–24) experienced significant growth, surging from 136 notifications in 1996 to 1199 notifications in 2014. These statistics illustrate the changing landscape of international trade regulations.

The heightened utilization of SPS measures also reflects the response of governments when markets fall short in providing adequate health and safety safeguards. In such cases, governments have turned to alternative trade policy strategies as a means of addressing the concerns of well-informed and health-conscious consumerss (Roberts et al. 1999). Consequently, many scholars have redirected their research focus toward examining the impact of Non-Tariff Barriers, particularly SPS measures, on international trade dynamics.

An analysis of the literature on Non-Tariff Barriers (NTBs) reveals that quantification methods can be broadly categorized into two groups: ex-post approaches and ex-ante methods. Ex-post approaches predominantly rely on gravity-based econometric models to estimate the observed impact of NTBs on trade levels. In contrast, ex-ante methods offer simulations of tariff equivalents, predicting the unobserved welfare impacts.

From an ex-post perspective, empirical studies have yielded diverse findings regarding the impact of NTBs on exports. Standards and technical regulations are often depicted as protectionist measures. Empirical evidence suggests that Sanitary and Phytosanitary (SPS) measures, for instance, can act as trade barriers by limiting competition within the domestic market and increasing costs for foreign suppliers. However, it's worth noting that the literature presents a range of conclusions, emphasizing both the beneficial and trade-inhibiting effects of policy requirements.

(Sedigheh and Zahra 2012) suggest that SPS and TBT measurements have a statistically significant negative impact on export of pistachios from Iran. (Nguyen and D. D. 2022). found that SPS measures imposed by importing countries have significant negative impacts on Vietnam's rice export. (Wood, Wu, Li and Kim, 2019) suggest that Chinese TBT measures were found to have a statistically insignificant negative impact on Korean exports to China. (Wood, J., Wu, J., Li, Y. et al. 2017) suggest that Chinese SPS measures have a negative, albeit insignificant effect on the sample as a whole. However, when looking at the individual countries, the SPS measures were seen to have a significant negative effect on Japan, New Zealand and the U.S., while from a Korean perspective, their impact was positive and significant. Positive impact shows that SPS measures may provide benefits to the exporters and consumers. For instance, when a product complies with a standard that certifies it as safe, healthy, or meeting specific quality criteria, it can stimulate higher consumer demand for imports. This increased demand has the potential to boost profits for foreign companies, even in the face of initial cost challenges. Research conducted by Henson, S., & Jaffee, S. (2008), Maertens and Swinnen (2009), and Henson and Humphrey (2010) have established that as the demand for high-quality products has risen, Sanitary and Phytosanitary (SPS) regulations have compelled producers and exporters to invest in improving their product quality. This, in turn, has enhanced their capacity to access larger markets for their agricultural products. These findings indicate that while exporters may encounter some initial compliance costs, they can, in the long term, stabilize these expenses and, as a result, increase their export volumes to international markets.

Table 2: Summary of Literatures

| LITERATURES | EXPORTER | IMPORTER | PRODUCT | IMPACT |
|---|---|---|---|---|
| Sedigheh and Zahra 2012 | Iran | Top importers | Pistachios | Negative |
| Nguyen and D. D. 2022 | Vietnam | Top importers | Rice | Negative |
| Wood, Wu, Li and Kim, 2019 | South Korea | China | Agricultural products | Negative |
| Wood, J., Wu, J., Li, Y. et al. 2017 | world | China | All products | Negative |
| | Japan, New Zealand, USA | China | All products | Negative |
| | South Korea | China | All products | Positive |
| Henson, S., & Jaffee, S. (2008) | India, South Korea | EU | Fish, Horticulture | Positive |
| Maertens and Swinnen (2009) | Senegal | EU | Horticulture | Positive |
| Henson and Humphrey (2010) | Many countries | EU | Agricultural products | Positive |

The contrasting empirical perspectives found in the literature underscore the need for further analysis. Additional research is essential to offer a more definitive understanding of the influence of SPS and TBT measures on trade levels. Hence, this paper sought to examine the impact that these measures have on Indian rice exports to the European Union, United States of America and Japan.

## 3. EMPIRICAL FRAMEWORK AND DATA

### *3.1 Basic Empirical Model*

Gravity model has been used to capture the trade impacts of SPS and TBT measures. Moenius (2006) and Mahe (1997) also confirmed that the gravity model is one of the most successful and hence widely used frameworks for empirical analysis of trade flows between countries. It has some advantages over other models as it requires only a limited amount of data, has strong theoretical backing and is able to hold the trade-enhancing effect of regulations and the distinct forms of NTBs in estimation of the trade flows. The specific model used in this paper includes the regression variables that are mostly included in a standard gravity model. The paper uses the following functional form:

$$LnEX_{ijt} = \alpha_0 + \alpha_1 LnNNIpc_{it} + \alpha_2 LnNNIpc_{jt} + \alpha_3 LnD_{ijt} + \alpha_4 LnT_{ijt} + \alpha_5 SPS\&TBT_t + \varepsilon_{ijt}$$

Where Ln is the natural log. The dependent variable ($EX_{ijt}$) is the real value of Rice exports from country i (India) to country j. $NNIpc_{it}$ is the per capita national income of India, $NNIpc_{jt}$ is the per capita national income of the importing countries (Benin, China, Saudi Arabia, United Arab Emirates, European Union, United States of America and Japan), $D_{ijt}$ is the distance between India and the importing countries, $T_{ijt}$ is the import tariffs imposed by the importing countries on Indian Rice. Tariff data has been elevated by 1 percentage point to account for zero tariff rates. The main focus of this paper is to analyse the trade impact of SPS and TBT measures imposed by the European Union, United States of America and Japan. A dummy variable (SPS&TBT) for these measures is taken. SPS&TBT=1 for the European Union and Japan for years 2001-2020 and for the USA for years 2013-2020. SPS&TBT=0 for other importing countries for years 2001-2020 and for USA for years 2001-2012.

National income of the countries includes both productive and consumptive capacity that mainly determines the trade flow between the countries. National income of the exporting country plays a significant role in determining the productive and exporting capacity for the goods. National income of the importing countries plays a significant role in determining the demand for the goods as well as its own capacity to produce those goods domestically along with its capacity to consume better substitutes of the goods. Hence its impact is inconclusive. A larger population could mean enlarged market size but also a reduced per capita national income and hence its impact is captured by taking per capita national income of the countries. Distance is another very important variable that impacts trade flow by capturing the trade costs between countries. Countries with shorter distance between them are expected to trade more due to a lower transportation cost. Tariff rates imposed by the importing countries also play a major role in determining trade flow as it is used to restrict the trade flow by increasing the price of the goods. A higher tariff rate is expected to reduce the trade flow between countries. The impact of SPS and TBT measures on trade flow is inconclusive. A stringent food safety measures may effectively restrict exports by increasing the cost of compliance. However, if the exporting country has up-to-date production systems and is capable of abiding by the measures, then the exports might actually increase.

Figure 3: Indian Rice exports to EU, USA and Japan

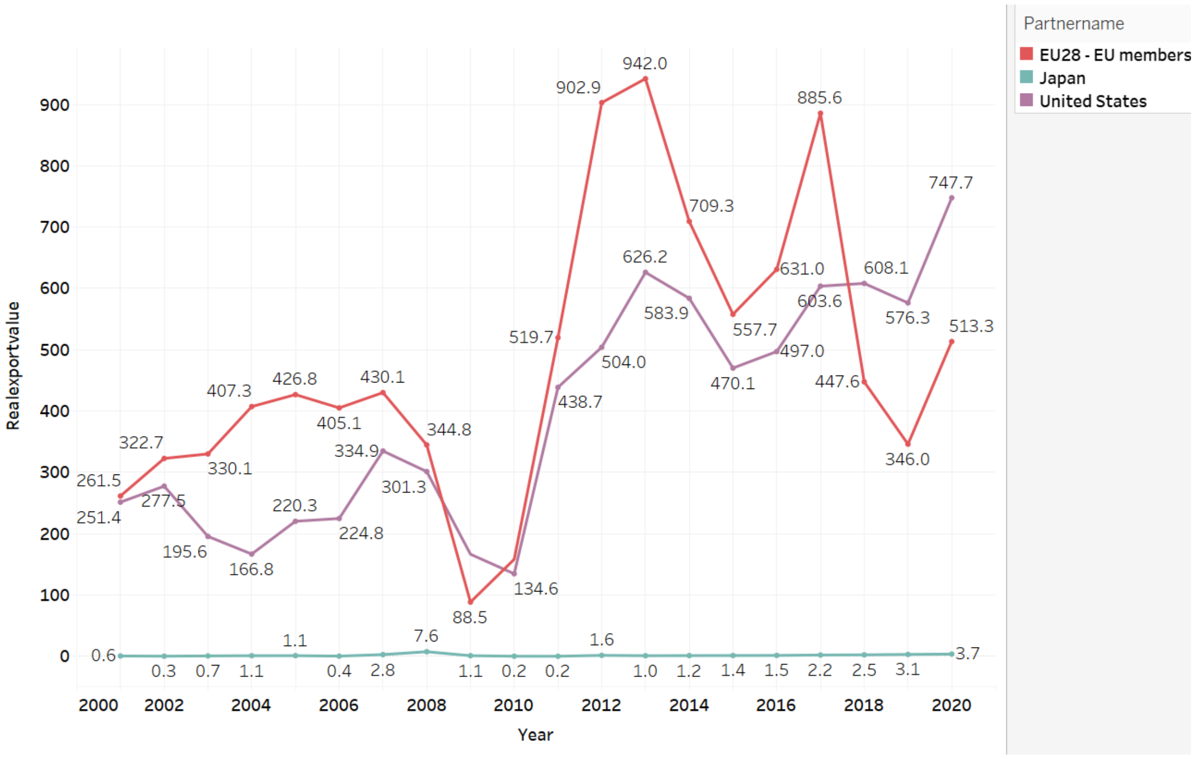



Figure 3 shows the trend of rice exports from India to EU, USA and Japan between years 2001-2020. It suggests that on an average, there is an increase in Indian rice exports to these countries.

Table 3: Average Tariff imposed by countries over the period 2001-2020

| IMPORTING COUNTRIES | AVERAGE TARIFF |
|---|---|
| Benin | 9.999 |
| China | 67.732 |
| EU | 7.7 |
| Japan | 0 |
| Saudi Arabia | 0 |
| United Arab Emirates | 0 |
| United States | 6.0455 |

Table 3 shows the average tariff imposed by the importing countries over the period 2001-2020. Japan, Saudi Arabia and UAE have imposed zero tariff on Indian rice, whereas China has imposed very high tariff.

*3.2 Data Source*

Data for GDP per capita for all countries has been obtained from the World Bank database. The trade flows of Rice (HS 1006) from India to the importing countries and the tariffs imposed by the importing countries on Indian Rice has been obtained from WITS database. The distances have been extracted from the CEPII database. The distances are calculated as the sum of the distances between the biggest cities of both countries, weighted by the share of the population living in each city and is expressed in km terms. The export values are expressed in 1000 US$ terms. The data has been deflated using export price index of rice, which was obtained from RBI's Handbook on Statistics. The values of GDP per capita are expressed in US$(constant 2015) terms. The data on tariff is calculated as the weighted average of MFN tariff rates imposed by the importing countries on Indian Rice. All data for all the variables are included in the analysis for the time period 2001-2020.

**4. RESULTS**

In this paper, the trade flow of Rice from India for the duration 2001-2020 are investigated. The major importers of Rice from India are Benin, China, Saudi Arabia and United Arab Emirates.

Breusch-Pagan LM Test has been done to choose between Pooled and Random Effect model. As per the result, Pooled model is chosen in this paper to undertake the analysis of the panel data. The classical econometric problems of the model have been tested. High multicollinearity was found between the variables GDP and Population, which has been corrected for by taking transformed variable GDP per capita. Robust standard errors have been used to account for heteroscedasticity. No serial autocorrelation has been found as per Wooldridge test (shown in Appendix). Summary Statistics is shown in Table 4 and the result of the model is given in Table 5. The coefficient of all the variables have been found to be significant.

Table 4: Descriptive Statistics

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| lnEX | 140 | 4.492 | 3.41 | -7.889 | 8.317 |
| lnNNIpci | 140 | 7.13 | .294 | 6.656 | 7.573 |
| lnNNIpcj | 140 | 9.666 | 1.348 | 6.812 | 11.014 |
| lnD | 140 | 8.613 | .543 | 7.785 | 9.491 |
| lnT | 140 | 1.526 | 1.496 | 0 | 4.745 |

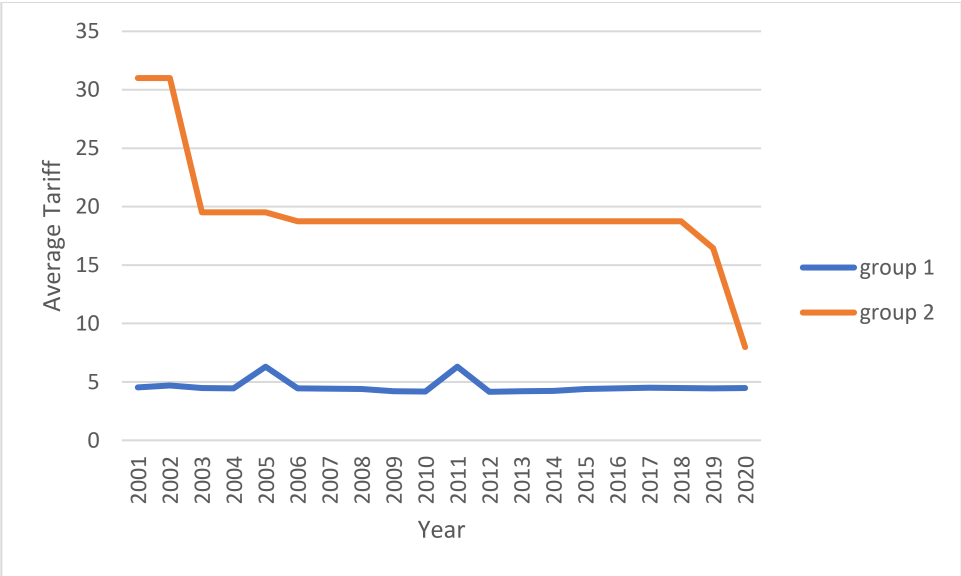
Table 5: The results of the model estimation

| | (1) | (2) |
|---|---|---|
| VARIABLES | 1 | 2 |
| lnNNIpci | 2.009** | 2.107*** |
| | (0.837) | (0.777) |
| lnNNIpcj | 1.043*** | 0.494*** |
| | (0.180) | (0.178) |
| lnD | 1.045*** | 1.941*** |
| | (0.391) | (0.411) |
| lnT | | -1.047*** |
| | | (0.237) |
| SPS_TBT | -3.206*** | -3.436*** |
| | (0.579) | (0.676) |
| Constant | -27.84*** | -29.29*** |
| | (7.297) | (6.876) |
| Observations | 139 | 139 |
| R-squared | 0.202 | 0.334 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Because of the log-log nature of the model, the variable coefficient value is the elasticity. According to the column 2 of the table, with a 1 percent increase in India's GDP per capita, there would be 2.1 percent increase in India's Rice exports and with a 1 percent increase in Importer's GDP per capita, there would be 0.45percent increase in India's Rice exports to these importing countries. The log of distance has a positive sign. This could be because of economies of scale and strong taste and preference. With a 1 percent increase in distance between India and the importing countries, there would be a 1.9 percent increase in India's Rice exports to these importing countries. With a 1 percent increase in tariff rates by the importing countries, there would be 1.05 percent decrease in Rice exports from India to these importing countries. The coefficient of the dummy variable SPS-TBT is negative and highly significant, which means that, with an imposition of SPS and TBT regulations by the EU, USA and Japan, there would be 3.44 percent decrease in Rice export flow from India. Column 1 does not control for tariff rates. However, the coefficient of SPS and TBT measures is not much different from that in column 2, which means that tariff has very little impact on Indian rice exports to the countries that has imposed SPS and TBT measures; and much of the variation in Indian rice exports is due to SPS and TBT measures. The result is in line with the findings of (Wood, J., Wu, J., Li, Y. et al. 2017), (Sedigheh and Zahra 2012) and (Nguyen and D. D. 2022). Figure 4 further supports the result by reflecting that group of countries which implemented SPS and TBT measures (group 1) had very low tariffs as compared to the comparison group of countries which didn't implement any SPS or TBT measures (group 2).

Figure 4: Average tariff rates




## 5. CONCLUSION

Thus, the obtained results suggest the following conclusions: SPS and TBT measures imposed by the European Union, United States of America have a highly significant negative impact on Indian Rice exports, thus restricting exports. According to WTO rules, the most important reasons for countries to adopt regulations under the SPS and TBT agreements are in order to protect human, animal and plant health as well as the environment, wildlife and human safety. On the other hand, the export and the world demand for agricultural products is increasing focusing on quality, packaging, labelling and standards of products. A significant negative effect suggests that India is not successful in abiding by the SPS and TBT rules.

Hence, India needs to build capacity to produce higher quality rice in order to not hamper its rice exports to mainly the developed countries.

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## APPENDIX

### Wooldridge test for autocorrelation in panel data

H0: no first-order autocorrelation
F (1, 6) = 0.345
Prob > F = 0.5783